

# Environmental Control System Software & Hardware Development

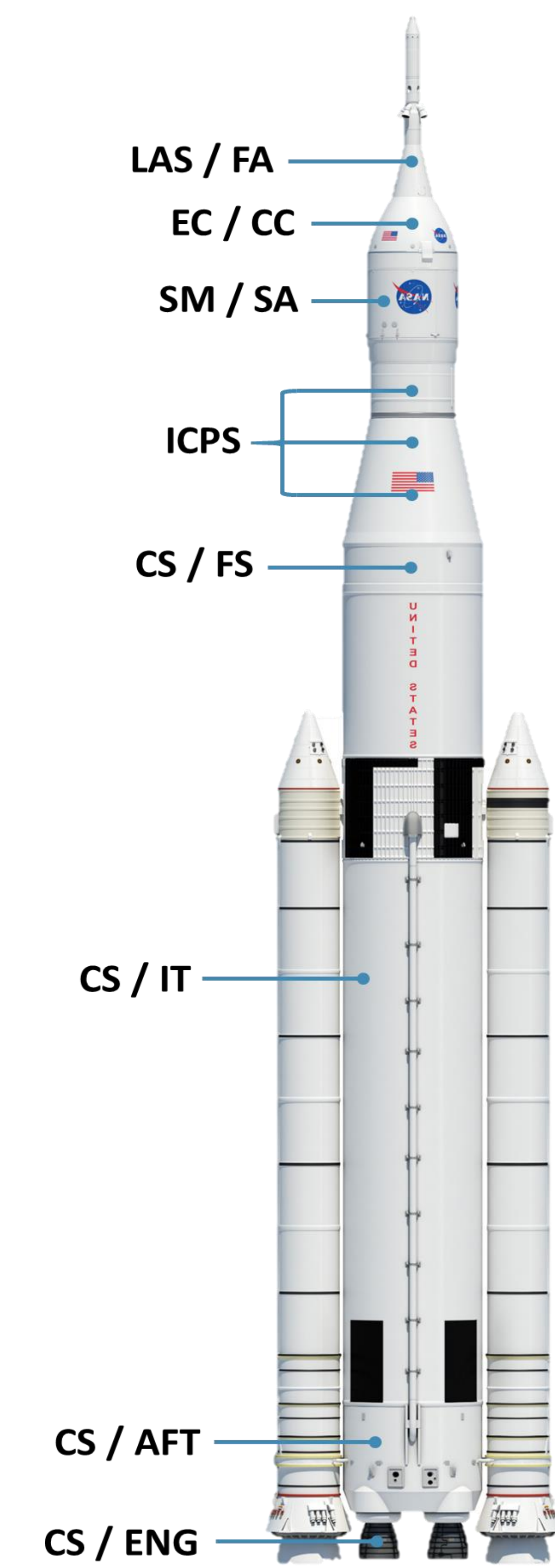


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## Background

- Bachelor’s Degree in Mechanical Engineering (2015)
- Graduate Research Assistant at the Center of Space Exploration and Technology Research

## SLS ECS Interfaces



Acronym	Description
LAS / FA	Launch Abort System / Faring Assembly
EC / CC	Environmental Chamber / Crew Cabin
SM / SA	Service Module / Spacecraft Adapter
ICPS	Interim Cryogenic Propulsion Stage
CS / FS	Core Stage / Forward Skirt
CS / IT	Core Stage / Inter Tank
CS / AFT	Core Stage / Aft
CS / ENG	Core Stage / Engines

Figure 1. SLS ECS Interfaces

## Introduction to ECS

### ECS Hardware

- Provides controlled purge to SLS Rocket and Orion spacecraft
- Provide mission-focused engineering products and services to a broad set of programs at Kennedy Space Center

### ECS Software

- NASA requires Compact Unique Identifiers (CUIs)
  - Fixed-length identifier used to identify information items
- CUI Structure
  - Composed of nine semantic fields that aid the user in recognizing its purpose

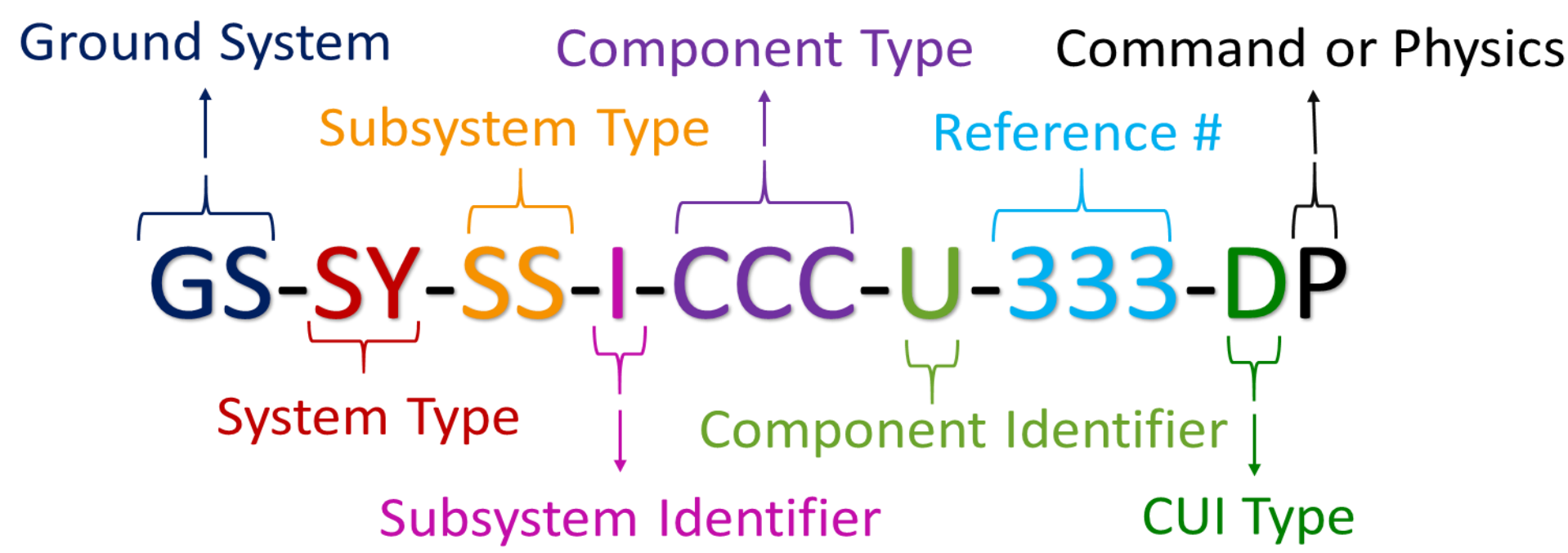


Figure 3. CUI nomenclature



Figure 2. Standby Blower

## Role and Tasks

### Main team role and responsibility

- Assist the NE-M3 team to develop and test the MPPU and Launch Pad ECS software
- Perform Refrigeration Load Calculations of the KSC Launch Pad 39-B

### Completed and Current Tasks

1. Create and/or modify MPPU software CUIs to meet NASA standards (Spring 2016)
2. KSC Launch Complex 39-B Environmental Control System refurbishment Refrigeration load calculation due to new blowers (Summer 2017)

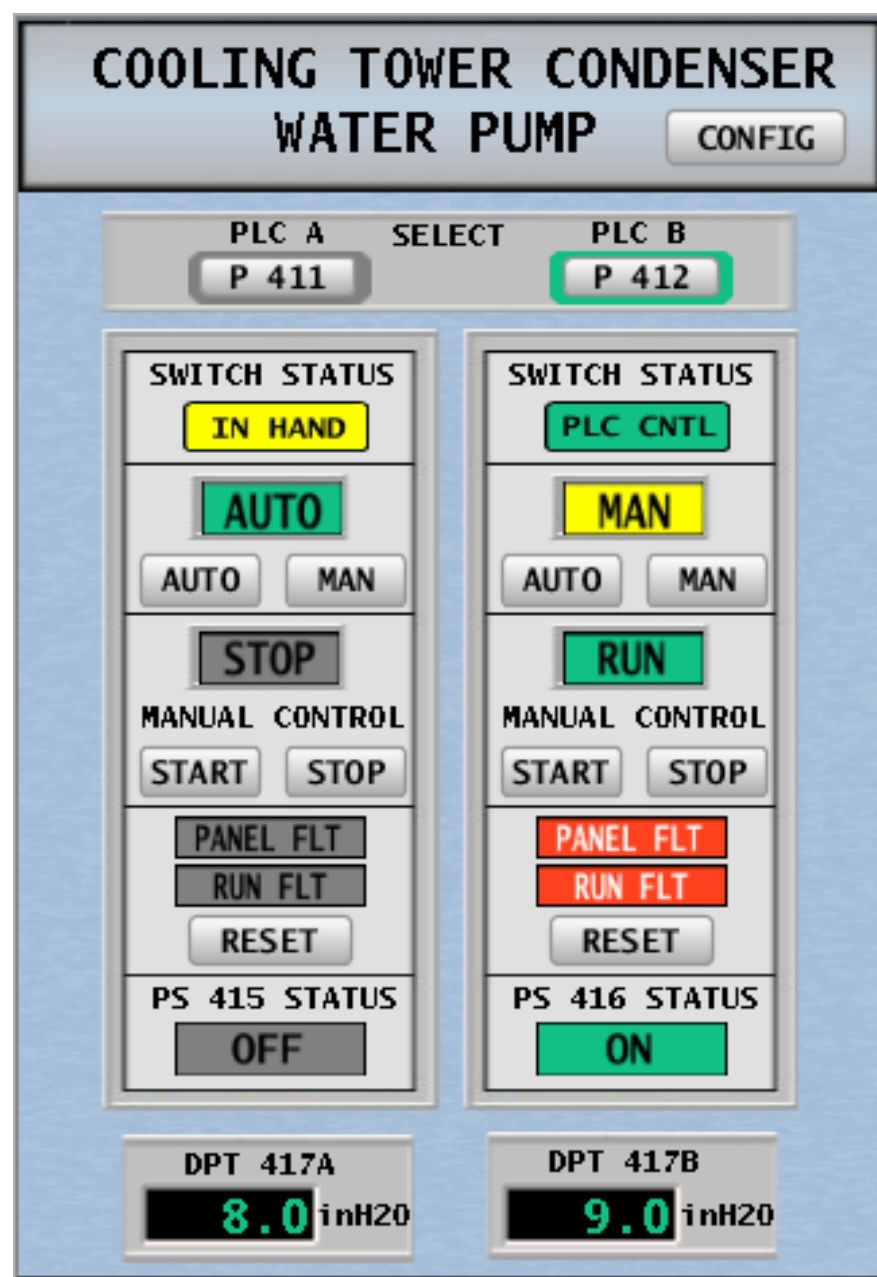
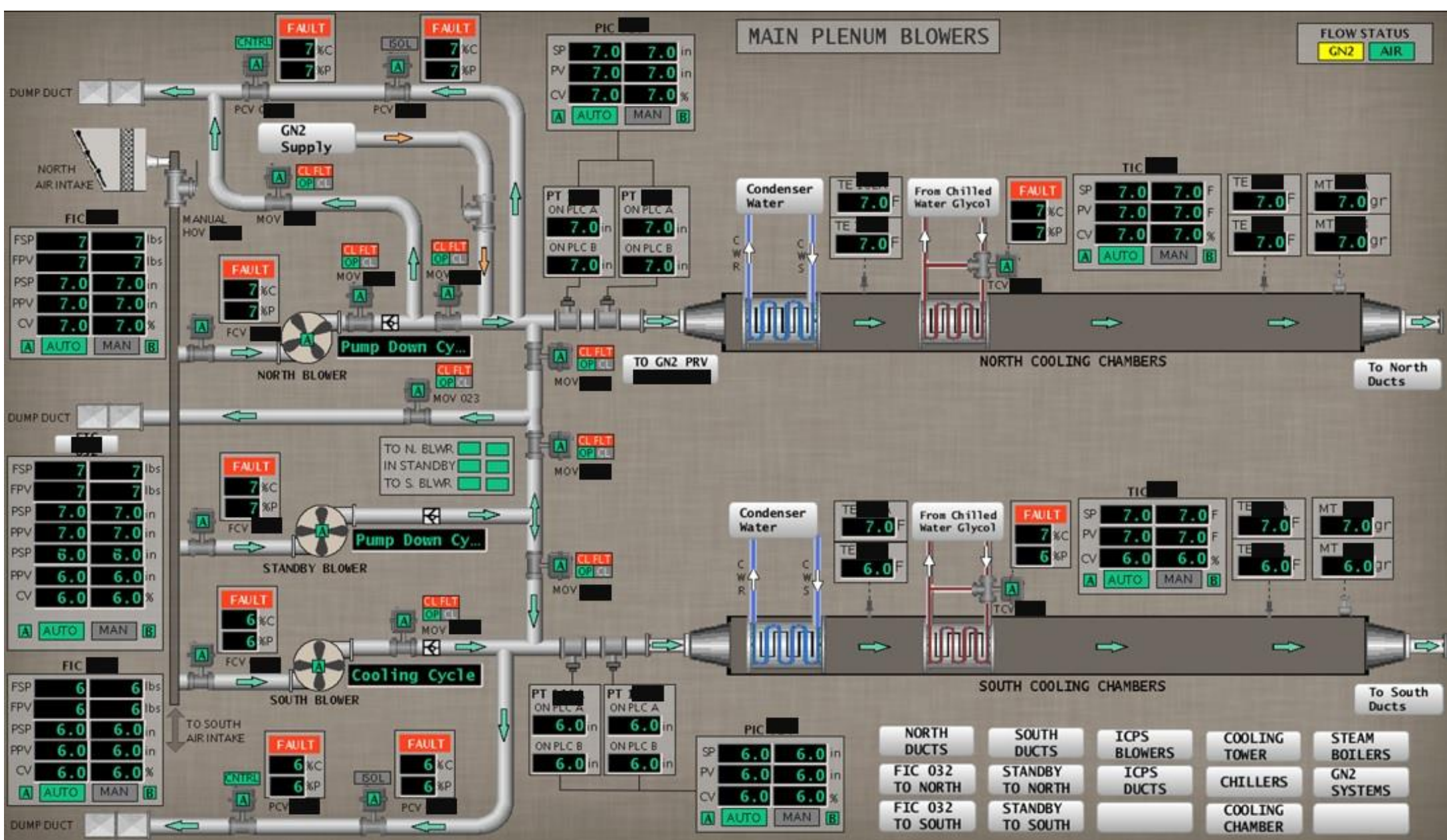


Figure 4. Launch Pad ECS Remote Screen Examples (Credit: J.Wilkas)

## Accomplishments / Conclusion

### Main Accomplishments:

- ~300 MPPU software CUIs were verified with the PLC software/code and engineering spec drawings
- Remote screens were created for use in the LCC
- Learned the basics AFT software to perform flow analysis
- Complete understanding of the MPPU and Launch Pad ECS system

### Conclusion:

- ✓ Helped the NE-M3 team to advance the effort to complete and verify the MPPU and Pad ECS software
- ✓ Experience with ECS = ready to provide invaluable support for the team when converted
- ✓ Mechanical understanding of refrigeration systems is vital for software development

## Future Directions

- MPPU software regression test – final verification
  - Test against hardware
  - MPPF, LASF, and transporter
- Launch Pad ECS initial software revision
- Personal: Graduate December 2017 with my M.S Mechanical Engineering

## Acknowledgements

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